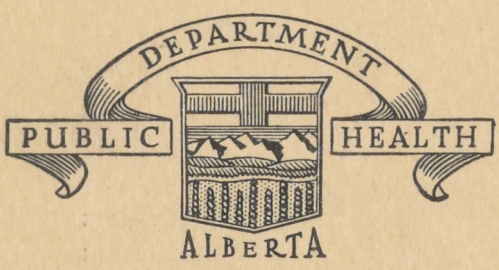
RURAL SEWAGE DISPOSAL



DIVISION OF SANITARY ENGINEERING

Issued by the direction of

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Minister of Health

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SEWAGE DISPOSAL

INTRODUCTION

The fact that many of the communicable diseases are transmitted from one person to another as a result of the fecal contamination of food or water makes it necessary that human excreta be so disposed of that no opportunity will exist for the transmission of infection. Safe disposal of sewage may be defined as that which renders impossible the contamination of any water supply, which effectively prevents any contact whatsoever with the ejected feces, and which successfully insures against exposure to flies and the development of nuisances.

Human excreta may be disposed of safely in a number of different ways. Where running water is, or can be made available, modern flush toilets connected to a public sewerage system is most desirable. The authority operating the system is responsible for safe sewage disposal and the private householder is relieved of this problem. Where running water is available, but no public sewerage scheme is provided, some treatment device must be constructed which will not only dispose of fecal matter safely, but will also handle considerable quantities of contaminated water without danger to the public. Where necessity prevents the installation of flush toilets in the home, safe arrangements then are necessary for the disposal or storage of body wastes at the place of deposition.

Sewage Treatment Devices for Systems Connected with Flush Toilets.

Appurtenances.

PLUMBING

Good plumbing is essential to the proper functioning of the house drainage system. All plumbing fixtures should be fitted with properly vented traps on the drain pipes to keep odours out of the rooms. Seepage water from cellars and rain water from roofs and other areas should not be drained into any private sewage disposal device, or into any public sanitary sewers without the permission of the authorities operating same. The main soil pipe should be extended through the roof to vent the drainage system. The services of a competent plumber should be secured.

HOUSE SEWER

Provincial Board of Health Regulations require that the sewer used to conduct the liquid waste from the point at which the cast-iron house drain ends outside the house wall to the public sewer or to any sewage treatment device be constructed of tight-

jointed vitrified clay sewer pipe or of cast-iron pipe at least 4 inches in diameter and laid with a fall of not less than 2 feet in each 100 feet for 4-inch sewers, or 1 foot in each 100 feet for 6-inch sewers.

The sewer should be located at sufficient depth to protect it from damage caused by external loads or from low temperatures. It should be kept away from trees and shrubs so as to minimize difficulties caused by clogging with roots. Sections of sewer line which pass within 50 feet of a well or source of water supply should be of Cast Iron with carefully caulked lead joints. No kind of sewer should be placed within 25 feet of any well or source of water supply.

Connecting Sewers Between Various Treatment Devices.

Various treatment devices will be described later in this bulletin. Wherever connecting sewers are constructed between a septic tank and the main distributor of a subsurface sand filter, or between a septic tank and a leaching cesspool, such sewers should preferably be of vitrified clay sewer pipe laid with cement mortar joints and should have a fall of at least 1 foot in each 100 feet.

Septic Tanks

GENERAL

Contrary to popular belief septic tank treatment does not result in a high degree of purification of sewage, but if properly operated and taken care of, simply provides a means whereby some of the solids in the sewage are removed so that final disposal in cesspools, subsurface tile systems or other means may be more readily and satisfactorily accomplished. The effluents from septic tanks are in some respects more objectionable than the influents and can only be discharged on to the surface of the ground, into ditches or into small streams under exceptional circumstances, if nuisances are to be avoided. The discharge of effluents from septic tanks on to the ground surface or into ditches, streams, lakes, etc., is prohibited unless authority so to do is obtained from the Provincial Board of Health.

LOCATION

Provincial Board of Health Regulations require that no part of any septic tank shall be located within 2 feet of any lot line, or within 10 feet of any cistern, or within 25 feet of any source of water supply used for domestic purposes, and that where practicable greater distances should be provided.

Septic tanks should be so located that if leaks develop in the tank or in the sewer leading thereto, contamination of a well or spring, or drainage of sewage into the house basement will not be possible. For the latter reason septic tanks should be

constructed a reasonable distance away from any concrete basement.

The site of the septic tank should not be subject to flooding by surface water and should be readily accessible to facilitate inspection and the removal of digested solids.

SIZE OF TANK

The liquid contents of a septic tank should be such as to provide at least one day's sewage flow from the house, and are required by regulations, never to contain less than 40 cubic feet (i.e. 250 Imperial gallons). The details and sizes of septic tanks capable of handling the sewage from a specified number of persons are shown on Sheet Number 1.

CONSTRUCTION FEATURES

Sheet Number 1 shows a typical septic tank. The accompanying table shows the various dimensions necessary to give the storage requirements stipulated above. The essential features are the water-tight reinforced concrete construction, removable plank roof or alternative clean-out manholes, the vertical inlet pipe to carry the sewage down before it moves longitudinally along the tank and also to allow offensive gas to escape from the tank, and the submerged outlet pipe to prevent the escape of floating scum and grease. The inlet pipe should be at least 3 inches higher than the outlet pipe.

Sheet Number 1 also shows a typical septic tank to which has been added what is known as a siphon chamber. The fact that such a chamber has been added does not affect in any way the dimensions of the septic tank itself, which should be the same as if no siphon chamber were provided. Siphon chambers are not usually employed when the effluent from the septic tank is to be finally disposed of into a leaching cesspool. They are often used where the effluent from the septic tank is to be finally disposed of into a subsurface tile system or into a subsurface sand filter. The siphon chamber affords a means of discharging the effluent of the septic tank to the subsurface tile system or to the subsurface sand filter in periodic flushes. Persons favouring the addition of a siphon chamber to a septic tank contend that such flushing results in a better and more uniform use being made of the subsurface tile or the subsurface sand filter, and that in Alberta winters, the possibility of freezing the system is reduced. On the other hand, numerous Alberta installations have been made without the siphon chamber with very satisfactory results. It should be noted that a siphon chamber makes it necessary to lay the subsurface field tile, or the subsurface sand filter approximately 18 inches deeper than would be necessary if no siphon chamber were employed. Persons providing siphon chambers in conjunction with septic tanks should

be careful to see that the dimensions shown on Sheet Number 1 are closely adhered to, if satisfactory results are to be obtained.

Concrete in the proportions of 1 part cement to 5 parts of clean gravel by volume makes a desirable mix for septic tank construction. Only enough water to wet the ingredients thoroughly should be used, as excess water weakens concrete.

The excavation should be prepared and the floor should be poured first. The wall forms may then be set in place and the walls poured in one continuous operation so that there will be no construction joints. The walls should be well tamped during pouring. Following the removal of the forms, stone pockets and the joint between the floor and the wall should be plastered with cement mortar. Plastering the inside of the whole tank with a cement mortar also is likely to render the tank water-tight.

Reference to Sheet Number 1 shows two alternative methods on constructing septic tank roofs. In one case the roof is made of 3-inch fir timber set in slots, which planking may be wholly removed at such times as the tank is being cleaned. As an alternative to the timber roof, reinforced concrete may be employed, but if such construction is used, manholes must be provided to allow access to the tank and to the siphon chamber. Concrete roof construction is preferable to timber for large tanks and for tanks over which heavy loads are likely to pass.

COMMERCIAL SEPTIC TANKS

There are a number of metal, vitrified tile and pre-cast concrete septic tanks on the market which may be obtained complete, ready for installation. In purchasing a commercial septic tank the purchaser should not be misled by claims of high efficiency which are frequently made, and regulations of the Provincial Board of Health specify that such tanks must have a liquid capacity of at least 250 Imperial gallons. In the case of steel septic tanks, regulations of the Provincial Board of Health require that such tanks bear a metal plate stamped with the name of the manufacturer, the liquid capacity of the tank, and certifying that the iron plate used in the tank's construction is of 12 gauge or heavier material. Tanks not bearing such plates should be regarded with suspicion.

OPERATION AND MAINTENANCE

Septic tanks reduce the velocity of flow so that the coarser and heavier solids carried in the sewage settle out. The settled material, or sludge, as it is better known, in the bottom of the tank undergoes bacterial decomposition resulting in gas production and partial liquefaction of the solids. A portion of the solids cannot be liquefied and accumulates in the bottom of the tank. Thus it is that after a period of about three to five years, all

septic tanks should be opened up and the accumulated sludge removed. Otherwise the sludge will build up to such a depth that it will be carried out the outlet pipe of the tank and seriously interfere with subsurface tile, leaching cesspools or subsurface sand filters used for the final disposal of the effluent.

The gas resulting from breaking down of the sludge, as it rises through the liquid in the upper portion of the tank entrains particles of sewage which are attempting to settle and carries them to the surface where they mix with the grease from the sewage which also rises to the top of the tank. Thus a scum is formed on the top of the tank which is prevented from getting out by the inverted outlet pipe. A number of small sewage particles, however, do pass out the effluent pipe, and these along with the soap present in the effluent give the latter a dark objectionable appearance and the gas present imparts a very objectionable odour.

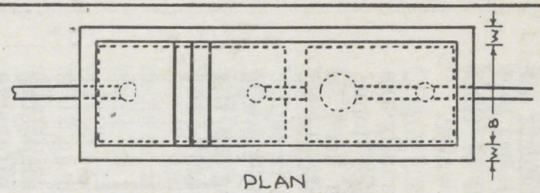
The sludge and scum in a septic tank should never be allowed to occupy more than one quarter of the total capacity of the tank and as pointed out before, the tank should be cleaned out periodically to prevent excessive accumulation of these substances. Sludge may be removed from septic tanks by bailing them out, or by the use of sludge pumps. The products so removed from a septic tank should be buried in shallow pits and should not be dumped into streams or be so disposed of that they might contaminate a source of domestic drinking water.

The bacteria in septic tanks are fairly hardy and usually are not affected by the various discharges from the average home, even where lye and other bathroom preparations are used in normal amounts to clean toilets, etc. Excessive amounts of poisonous chemicals have been known to kill the bacteria in septic tanks with the result that much of the solid matter in the sewage has passed completely through the tank, soon clogging up the sub-surface field, cesspool or subsurface filter used to handle the final effluent.

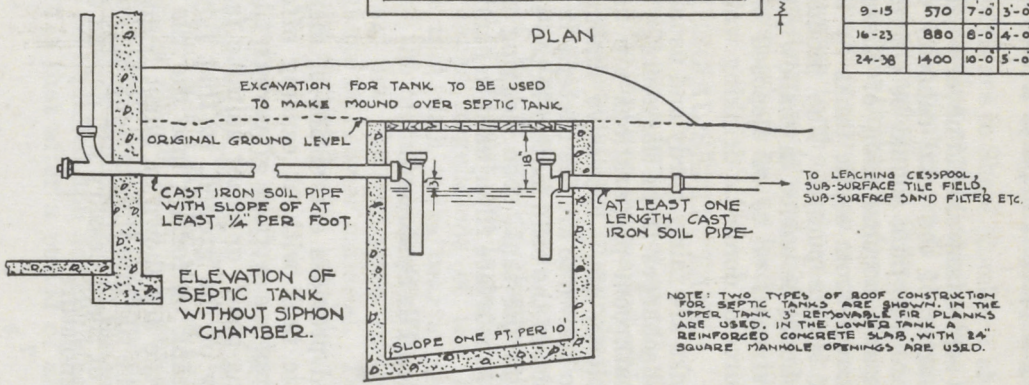
Sub-surface Tile Systems

GENERAL

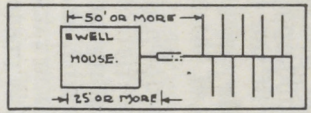
The sub-surface tile field provides one means of disposing of the effluent from a septic tank without causing offensive conditions. The system comprises a field of porous tile laid within open joints in "herring-bone" or other suitable fashion, depending on the topography of the ground, so that flow will take place from the septic tank uniformly into the tile field. Different methods of laying tile are shown on Sheet Number 2. The liquid wastes seep from the tile into the surrounding soil and it is obvious that the amount of tile necessary will depend on the capacity of the soil to absorb moisture.



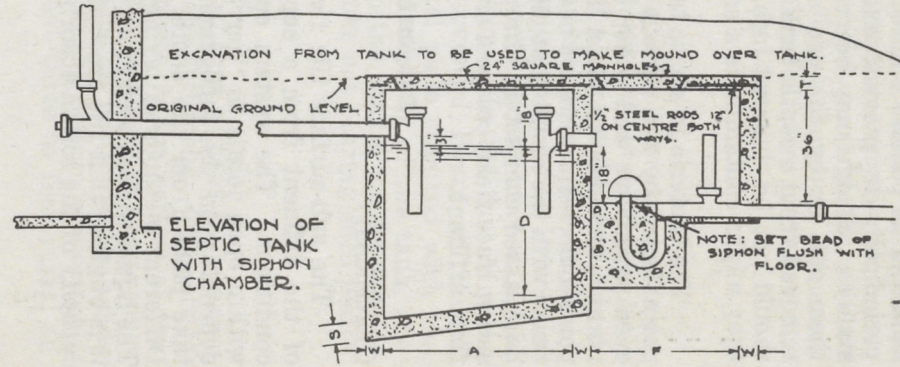
NUMBER OF PERSONS	TANK CAPACITY IMPERIAL GALLONS	DIMENSIONS SEPTIC TANK A	B	D	F	SIPHON CHAMBER CAPACITY	SIPHON SIZE	MINIMUM AMOUNT OF FIELD TILE (FT)	THICKNESS OF WALLS (IN) W	T	S
1-8	330	5'-0"	2'-6"	4'-0"	3'-6"	60 GALS	3"	140	6	4	6
9-15	570	7'-0"	3'-0"	4'-0"	5'-0"	100 "	3"	240	6	4	6
16-23	880	8'-0"	4'-0"	4'-0"	6'-6"	180 "	3"	430	6	4	6
24-38	1400	10'-0"	5'-0"	4'-6"	7'-0"	215 "	3"	525	6	5	6

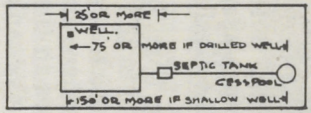


NOTE: TWO TYPES OF ROOF CONSTRUCTION FOR SEPTIC TANKS ARE SHOWN. IN THE UPPER TANK 3" REMOVABLE FIR PLANKS ARE USED. IN THE LOWER TANK A REINFORCED CONCRETE SLAB, WITH 24" SQUARE MANHOLE OPENINGS ARE USED.



PLAN OF TOWN LOT SHOWING LOCATION OF SEPTIC TANK AND SUB-SURFACE TILE FIELD IN RELATIONSHIP TO NEARBY WELLS AND HOUSES.

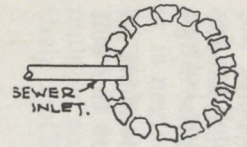




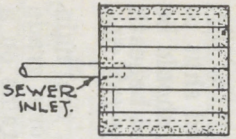
PLAN OF TOWN LOT SHOWING LOCATION OF SEPTIC TANK AND LEACHING CESSPOOL IN RELATIONSHIP TO NEARBY WELLS AND HOUSES. (NOTE: THE CONSTRUCTION OF LEACHING CESSPOOLS IN CITIES, TOWNS VILLAGES OR HAMLETS PROHIBITED UNLESS PRECEDED BY A SEPTIC TANK. THE DISTANCES SHOWN ON THE ABOVE TWO PLANS APPLY TO ANY WELL REGARDLESS OF WHOSE PROPERTY THE WELL IS LOCATED ON.)

— SEPTIC TANK CONSTRUCTION —

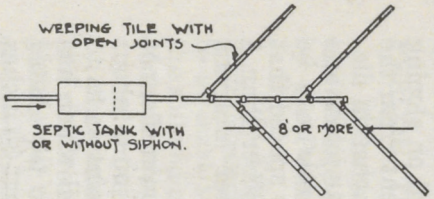
SHEET NO. 1.



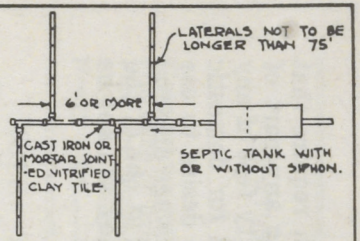
PLAN



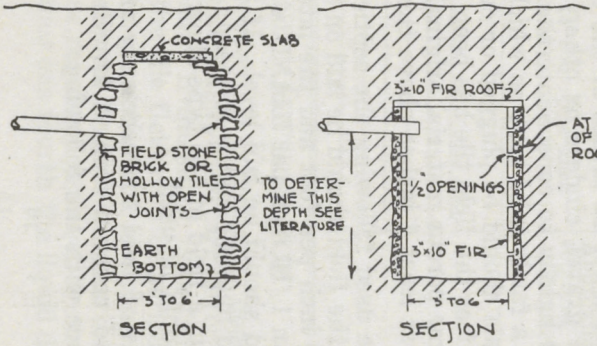
PLAN



THE HERRINGBONE SYSTEM.

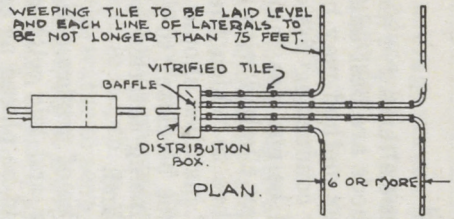


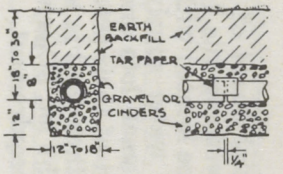
THE RIGHT ANGLE SYSTEM.

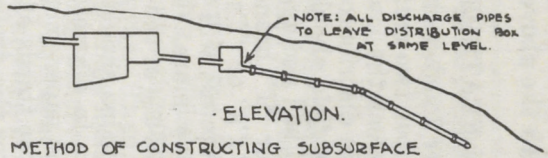


TYPICAL LEACHING CESSPOOL CONSTRUCTION.

NOTE: CESSPOOLS PRECEDED BY SEPTIC TANKS FUNCTION BETTER AND OPERATE LONGER BECAUSE THE TANK INTERCEPTS MOST OF THE GREASE AND SOLIDS.

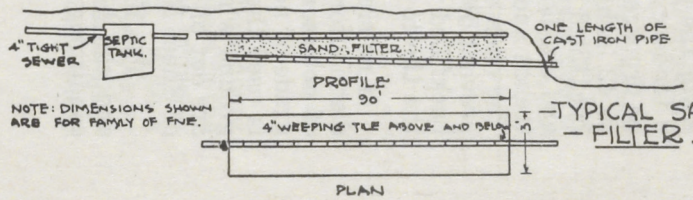




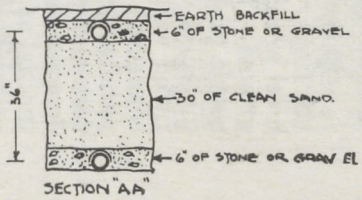


METHOD OF CONSTRUCTING SUBSURFACE TILE FIELD ON SLOPING GROUND.

TYPICAL METHODS OF LAYING SUB-SURFACE TILE FIELDS.



TYPICAL SAND FILTER.



DIFFERENT METHODS OF DISPOSING OF THE EFFLUENTS FROM SEPTIC TANKS.

LOCATION

Regulations of the Provincial Board of Health require that under no circumstances shall weeping tile forming any part of any system of sewage disposal be located within fifty feet of any well, spring or other source of water supply used for domestic purposes. **Persons located on small lots and who desire to use sub-surface tile drainage as part of their private sewage disposal scheme should make sure that their well is located at one of the ends and not in the middle of the lot, otherwise they will not be able to comply with the above requirement.**

CONSTRUCTION FEATURES

Sheet Number 2 shows three alternative methods of laying a tile field. The upper two methods are best adapted to relatively level ground, whereas the lower method may be used on sloping ground. The main distributor conducting the effluent from the septic tank to the field should be not less than 4 inches in diameter, of vitrified bell and spigot tile laid with mortar joints and fitted with "Y" or "T" branches to which the laterals may be connected. The "Y's" or "T's" installed should be so spaced that parallel lines of laterals will not be closer to each other than 6 feet and preferably more. Placing laterals at closer intervals does not make good use of the land.

The lateral drains should be of unglazed field drain tile, not less than 4 inches in diameter and laid with open joints about ¼ inch wide. Tar paper should be placed at each joint so as to cover the upper two thirds of the joint to exclude soil which has a tendency to enter the drain. The trenches for the tile should be prepared from 12 inches to 24 inches wide and about 30 inches to 42 inches deep. The lower 12 inches of the trench should be backfilled with coarse gravel, cinders or other porous material and should be tamped lightly to consolidate the material in the trench and thus form a fairly solid base on which to lay the tile. The ends of the laterals should be plugged or cemented shut to prevent overflows. After the field tile has been laid it should be backfilled with the same porous material originally used beneath the tile to a depth of at least 4 inches above the top of the tile.

If no siphon is to be used following the septic tank, the main distributor leading to the field should be laid on a uniform grade of not more than 1/8 inch per foot and the lateral drains on a grade of not more than 1/16 inch per foot. If a siphon chamber is used the whole field should be laid level. If the slope of the ground where the field must be laid is so steep that such grades are out of the question, a field of the type shown at the bottom of Sheet Number 2 should be used.

The linear lengths of field tile necessary are dependent on and can be determined roughly from a knowledge of the soil conditions in accordance with the following:

NATURE OF SOIL	Approximate length of 4-inch tile required when the sewage flow is 40 Imperial gallons per capita per day
	Feet per person
Clean coarse sand or gravel	15
Fine sand or light loam	20
Fine sand with some clay or loam	30
Clay with some sand or gravel	80
Heavy clay	Unsuitable

NOTE: The average person in rural communities in Alberta will ordinarily produce an average of from 25 to 40 Imperial gallons of sewage per day.

PERCOLATION TEST

If there is any doubt relative to soil conditions, the amount of drainage tile that should be laid may be determined as follows by the Percolation Test:

Dig a hole one foot square down to the depth to which the lateral trench will be subsequently dug. Fill the hole with water to at least two feet in depth to insure thorough moistening of the soil and allow the water to seep away. Then, while the bottom of the hole is still moist, fill to a depth of six inches, stick an ordinary ruler into the bottom of the hole and observe the time required for the water level to fall one inch. The approximate length of tile required per person, based on a sewage flow of 40 Imperial gallons per day, is given by the following table:

Time for Water to Fall One Inch (Minutes)	Approximate length of 4-inch tile required when the sewage flow is 40 Imperial gallons per capita per day
	Feet per person
2	15
5	20
10	30
30	60
60	80
Over 60	Unsuitable

OPERATION AND MAINTENANCE

The life of a tile field is primarily dependent on the amount of solid matter that is allowed to carry over into the system in the septic tank effluent. If the septic tank fails to function properly or is neglected, the tile field may be seriously affected. With a properly constructed septic tank and a carefully laid field, long years of service should be provided, on the condition that accumulated solids are regularly removed from the septic tank when their depth becomes one fourth the liquid depth.

It is not good policy in Alberta to put a septic tank and accompanying field into first operation late in the autumn, particularly after the ground has begun to freeze. For best results tanks and fields should be installed between the months of May and August. Furthermore, in the heavier soils of the Province it is almost essential to provide gravel backfilling around the field tile as previously described, if frost troubles are to be reduced to a minimum.

Leaching Cesspools

GENERAL

A second method of disposing of the effluent from a septic tank is by the use of leaching cesspools, or as they are sometimes known, as "dry wells." A cesspool is simply an excavation in the ground not larger than 6 feet square, or 6 feet in diameter and approximately 10 feet deep. The walls of a cesspool are usually cribbed to prevent the caving in of the walls. On some occasions the excavation is filled with large rocks and boulders, likewise to prevent caving.

Where soil conditions are exceptionally good and where clogging of the soil immediately surrounding the cesspool is not likely, cesspools may be used provided the ground water is encountered at sufficient depth that the bottom of the cesspool will not come within 5 feet of same.

LOCATION

Provincial Board of Health Regulations prohibit the construction of a cesspool in any city, town, village or hamlet, for the disposal of toilet wastes, unless it is preceded by a properly designated septic tank. The same requirement does not apply to wastes from kitchen sinks, lavatory basins or baths. Moreover the same regulations prohibit the construction of cesspools within 75 feet of drilled wells or within 150 feet of springs or shallow wells.

CONSTRUCTION FEATURES

Cesspools should preferably be used following a septic tank so that objectionable grease and solids will be largely removed from the sewage before it enters the cesspool. Thus the cesspool will function satisfactorily for much longer periods of time without the soil becoming clogged. Sheet Number 2 shows a typical design.

The construction should be such that a suitable manhole cover at least 20 inches square or in diameter may be removed to allow access to the pit.

Cesspools may be lined with cheap brick, building tile or field stone laid without mortar, but the upper portion must be suffi-

ciently stable to insure against collapse. Two-inch wood cribbing loosely constructed may also be used, but in time it will rot which may result in caving.

The leaching area into which the sewage can percolate should be calculated as the area of the walls below the flow line because the bottom will soon become clogged and be rendered ineffective. To obtain the effective leaching area of a circular cesspool multiply the diameter in feet by three times the depth below the flow line. The result will be in square feet.

The required leaching area to be provided may be determined roughly as follows:

CHARACTER OF SOIL	Effective leaching area per person required where sewage flow is 40 Imperial gallons per day
	Square feet
Clean coarse sand or gravel	12
Fine sand or light loam	15
Fine sand with some clay or loam	22
Clay with considerable sand or gravel	Generally unsuitable
Heavy clay	Unsuitable

EXAMPLE: What size cesspool would be required to handle the sewage from a family of five? Assume that each person is responsible for 40 Imperial gallons of sewage per day and that the type of soil encountered is a fine sand with some clay or loam. Effective leaching area required (from table) $5 \times 22 = 110$ square feet. A cesspool 4 feet square and 1 foot deep below the flow line would provide 16 square feet of leaching area. Therefore, the required depth of the cesspool would be 110 square feet divided by 16 square feet, i.e., 7 feet. Thus a cesspool 4 feet square and 7 feet deep below the flow line should satisfactorily serve the family's requirements.

If there is doubt as to the type of soil in which the cesspool is to be located, a percolation test conducted as follows on the soil in question affords a means of classifying the same:

Dig a pit approximately 3 feet by 3 feet to a depth of 6 feet below ground level. In the bottom of the pit dig another hole one foot square to a depth of one foot. Fill the last hole dug with water and allow it to seep away. While the bottom of the small pit is still moist, fill with water to a depth of 6 inches, stick a ruler into the ground at the bottom of the pit and observe the time required for the water to lower one inch. The leaching area required per person based on a sewage flow of 40 Imperial gallons per capita may be determined as follows:

Time for Water to Fall One Inch (Minutes)	Leaching Area Required when Sewage Flow is 40 Imperial gallons per Capita per Day. (Square Feet per Person)
2	12
5	16
10	25
30	50
Over 30	General Unsuitable

OPERATION AND MAINTENANCE

The solids which accumulate in a cesspool must be removed from time to time and be removed to some safe place for disposal. Whenever the liquid level in a cesspool reaches the level of the sewer inlet, the cesspool is either in need of cleaning or the surrounding soil has become so clogged that additional leaching area must be provided. Cesspools should be examined at least once each year to determine whether the above noted conditions exist. Such inspections are essential if overflow of the cesspool is to be avoided. If additional leaching area is required a second cesspool may be constructed and the old and new cesspools connected with tile pipe. The second cesspool should not be less than ten feet from the first.

Artificial Sub-surface Sand Filters

GENERAL

Where a soil is so tight that sub-surface irrigation systems and leaching cesspools are not practical, a sub-surface sand filter can sometimes be used, provided a suitable outlet is available. The use of sub-surface sand filters is rarely possible for lots within cities, towns or villages in that the necessary fall is not available and because there is no place to which the effluent can be discharged. The system, however, may be used quite satisfactorily on some farms, if the ground is rolling, or in connection with houses located close to some type of ravine or stream.

CONSTRUCTION FEATURES

Sheet Number 2 indicates how a sub-surface sand filter is constructed. The filtering material should be clean, coarse sand. The distributing tile and underdrain should be laid in graded gravel. The sand supporting the distributing tile should be laid over the collecting tile and should be allowed to stand for a considerable time, or should be flooded with water before the distributing tile is laid. If the distributing tile is laid on an unconsolidated sand bed, it is very apt to settle unevenly thus throwing the grade of the distributing tile badly out of line. For small installations the sub-surface sand filter is usually installed in a

filter trench three to four feet wide and as long as is deemed necessary, with a single distributor lateral and a single underdrain. The gravel layers and the sand bed should be as shown. For larger institutions a rectangular filter bed with a number of distributors is invariably used.

OPERATION AND MAINTENANCE

Similar to the sub-surface tile system, the sub-surface sand filter if properly constructed and used in conjunction with a properly constructed and maintained septic tank, should render long years of service. In time, however, it will become partially or wholly clogged due to suspended matter which escapes from the septic tank. When clogging occurs the upper portion of the sand may have to be replaced and the distributing tile relaid. The underdrains if properly constructed should not cause trouble.

Water-Tight Cesspools Requiring Pumping

GENERAL

It sometimes happens the ground available for disposing of the sewage from a building is so impervious, or so limited in area, that the construction of a sub-surface tile system, a leaching cesspool or a sub-surface sand filter is impractical. One alternative is the construction of a septic tank and accompanying leaching cesspool which may be periodically pumped out upon becoming full. Only the excess sewage which will not seep away has to be so pumped. The other alternative is the construction of a water-tight cesspool from which sewage may be pumped at regular intervals. Where such a scheme is used, it is not generally necessary to provide any septic tank.

The chief objections to the above described methods of sewage disposal are the odours produced in pumping, the requirements of many Towns and Villages that pumping be restricted, to, from midnight to 5 a.m., leaking tanks in which the sewage must be hauled, high cost and the difficulty in getting someone to do the job—admittedly a dirty one. Because of the objections outlined, such methods should only be used as a final resort and only on the condition that the system will be given careful supervision.

TAKE NOTICE - PERMISSION TO CONSTRUCT SEWAGE DISPOSAL SYSTEM SHALL BE OBTAINED FROM THE LOCAL PLUMBING INSPECTOR IN CITIES OR TOWNS WHERE SUCH OFFICE IS MAINTAINED, OTHERWISE FROM THE PROVINCIAL BOARD OF HEALTH.

Plumbing permits are also required to be taken out by the Plumbing Contractor installing the work, in accordance with Section 606 of the Provincial Plumbing Regulations.

DATE DUE SLIP

DUE CAM APR 30 '86	
RETURN APR 10	
DUE CAM APR 01 '87	
APR 07 RETURN	
DUE CAM JUL 23 '87	
JUL 21 RETURN	
Due Cam JUN 14 1993	
Due Cam JUL 23 1993	
Due Cam SEP 03 1993	
Due Cam OCT 06 1993	
OCT 06 RETURN	

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